Kazuko M. HASEGAWA*: **Cytotaxonomic studies on the genera *Liriope* and *Ophiopogon* in Japan**

長谷川一子*: 日本産ヤブラン属および
ジャノヒゲ属の細胞分類学的研究

(Plates XII—XV)

The genera *Liriope* and *Ophiopogon* (Liliaceae, Ophiopogoneae) are widely distributed in the temperate and subtropical regions of eastern Asia, and in Japan are found three species of *Liriope*; *L. minor* (Maxim.) Makino, *L. platyphylla* Wang et Tang and *L. spicata* Lour., and four species of *Ophiopogon*; *O. japonicus* (L. f.) Ker-Gawl., *O. ohwii* Okuyama, *O. planiscapus* Nakai and *O. jaburan* (Kunth) Lodd. The habitats of them are generally lower moist wood or glasslands. Both genera are very characteristic among the genera of Liliaceae in having nude seeds, and have sometimes been treated as an independent family, Ohiopogonaceae. The pericarps are very thin, drop down soon after flower, and the globose seeds appear nude. The remarkable differences between the two genera exist in the shape of stamens and in the positions of ovaries. The anthers of *Liriope* are ovate with the filament as long as the anther, and those of *Ophiopogon* are lanceolate with a very short filament. The ovaries are superior in *Liriope*, and semi-inferior in *Ophiopogon*. In many cases, the flowers of *Liriope* direct upwards, but those of *Ophiopogon* are nodding. The fibrous roots of *Liriope* are more slender and branchy, while those of *Ophiopogon* thicker and not so branchy. The pollen grains of both genera are one-sulcate, the surface pattern is subreticulated; many granules are found on the sulcus in *Liriope*, but not in *Ophiopogon*. Almost all the species are widely cultivated in Japan, and the varieties with variegated leaves are found in *L. platyphylla*, *L. spicata*, *O. planiscapus* and *O. jaburan*.

Cytologically, their basic chromosome number has been considered to be X= 18, and their chromosome numbers were studied by Shimotomai, N. 1927, Matsuura, H. & Suto, T. 1935, Sato, D. 1942, Oinuma, T. 1944, 46, 49, and Nagamatsu, T. & Noda, S. 1964, 67 (Table 1). The intraspecific polyploidy was reported by

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Table 1. The chromosome number of the species of *Liriope* and *Ophiopogon* examined in this study.

| Present results | | | Previous reports | | |
|---|---|---|---|---|---|
| Species | 2n | Materials | n | 2n | Authors |
| *Liriope minor* (Maxim.) Makino | 36 | 17 wild materials from Hokkaido, Tōhoku, Kantō, Kinki, and Shikoku. | 18 | 36<br>36 | Matsuura, H. & Suto, T. 1935<br>Sato, D. 1943<br>Oinuma, T. 1946, '49 |
| *Liriope platyphylla* Wang et Tand | 72 | 24 wild materials from Tōhoku, Kantō, Chūbu, Kinki, Chūgoku, Shikoku, and Kyūshū, and 2 cultivated varieties with broader leaves and variegated leaves. 2 material from Milyang and Chechu-Island, Korea. | ca 36 | 72, 108 | Shimotomai, N. 1927 (under the name of *L. graminifolia* Bak. var. *communis* Nakai)<br>Oinuma, T. 1946, '49 (under the name of *L. muscari* Bailey var. *communis* Nakai) |
| *Liriope spicata* Lour. | 108<br><br><br>36 | 7 wild materials from Chūbu, Kinki and Shikoku, and a cultivated variety with variegated leaves. A material from Kwangnung, Korea.<br>A wild material from Mt. Iwaudo, Kyūshu. | | 108 | Sato, D. 1943 (under the name of *L. koreana*) |
| *Ophiopogon jaburan* (Kunth) Lodd. | 36 | 3 wild materials from Kyūshū, and a cultivated variety with variegated leaves. | | 36<br>36 | Matsuura, H. & Suto, T. 1935<br>Sato, D. 1943 |
| *Ophiopogon planiscapus* Nakai | 36 | 20 wild materials from Tōhoku, Kantō, Chūbu and Kyūshū, and a cultivated variety with dark-purple leaves. | 18 | 72<br>36, 72 | Sato, D. 1943<br>Oinuma, T. 1944, '46, '49 |
| *Ophiopogon japonicus* (L. f.) Ker-Gawl. | 72 | 24 wild materials from Tōhoku, Kantō, Chūbu, Kinki, Chūgoku, Shikoku and Kyūshū, and 2 cultivated ones. A material from Chechu-Island, Korea. | 36 | 36, 72<br>72<br>65, 66, 67, 68 | Sato, D. 1943<br>Oinuma, T. 1944, '46, '49<br>Nagamatsu, T. & Noda, S. 1964, 67 |
| *Ophiopogon ohwii* Okuyama | 72 | 26 wild materials from Kantō, Chūbu, Kinki, Chūgoku, Shikoku and Kyūshū, and a cultivated one. | | | |

Oinuma, T. 1946 & 49 in *O. japonicus*, *O. planiscapus* and *L. platyphylla*, and the evolution of the species of *Liriope* and *Ophiopogon* was discussed. In those studies, however, there remain some questions about the identification and the origin of the materials. The present study, therefore, attempts a more detailed cytotaxonomy of those species by using exactly identified materials from many different localities.

**Materials and Methods.** In this study, many plants were collected from their native habitats and transplanted into clay pots. The collections used are shown in Table 2. Voucher specimens of all these plants are preserved in the Herbarium of the University of Tokyo (TI).

The cytological technique applied in this study is the oxyquinoline-aceto-orcein squash method. Excised root tips were stored in 0.002 mol 8-hydro-oxyquinolin aqueous solution for 4-5 hours at 10-15°C, and subsequently, transferred into an watch-plate filled with aceto-orcein (2%)-1N hydro-chlonic acid (1 : 1) mixture. They were mildly heated over the flame for 5-6 seconds. Each of the root tips was then transferred onto a slide, treated with a drop of acetic-acid (45%)-glycerine-jelly mixture (1 : 1) after washed with a drop of acetic-acid (45%), and the root tips were squashed.

Table 2. Collections of *Liriope* and *Ophiopogon* (Transplants)

*Liriope minor*

| | Locality | Date | Collectors |
|---|---|---|---|
| 1. | Tachimachi-misaki, Hakodate-City, Hokkaido | Aug., 1965 | Kawano S., Ihara, M., & Okubo, K. |
| 2. | Kamo, Nishitagawa-gun, Yamagata Pref. | July, 1964 | Ihara, M. |
| 3. | Niiza, Kitaadachi-gun, Saitama Pref. | July, 1966 | Ohashi, H. |
| 4. | Inubō-saki, Chōshi-City, Chiba Pref. | June, 1967 | Sugiyama, M. |
| 5. | Ichinomiya, Chōsei-gun, Chiba Pref. | Sept., 1964 | Ihara, M. |
| 6. | Katsuyama, Awa-gun, Chiba Pref. | Nov., 1965 | Kanai,H.,Ohashi, H., & Okubo, K. |
| 7. | Ōshima Island, Tokyo | Nov., 1967 | Kanai, H. |
| 8. | Mt. Takiko, Ōtsuki-City, Yamanashi Pref. | Apr., 1965 | Hasegawa, K. M. |
| 9. | Mt. Tōgasa, Izu Peninsula, Shizuoka Pref. | Oct., 1966 | Hasegawa, K. M. |
| 10. | Shimoda, Izu Peninsula, Shizuoka Pref. | Apr., 1966 | Ihara, M. |
| 11. | Shimada-City, Shizuoka Pref. | Nov., 1967 | Tuyama, T. |
| 12. | Inuyama-City, Aichi Pref. | July, 1964 | Ihara, M. |
| 13. | Owase-City, Mie Pref. | Oct., 1965 | Hotta, M. |
| 14. | Shionomisaki, Nishimuro-gun, Wakayama Pref. | Oct., 1967 | Fukuda, Y. |

| Locality | Date | Collectors |
|---|---|---|
| 15. Kankakei, Shōdo Island, Kagawa Pref. | May, 1965 | Ihara, M. |
| 16. Sukumo-City, Kōchi Pref. | July, 1965 | Okubo, K. |
| 17. Tosayamada, Kami-gun, Kōchi Pref. | May, 1967 | Sasaki, I. & Kido, S. |
| *Liriope platyphylla* | | |
| 1. Inawashiro, Yama-gun, Fukushima Pref. | Aug., 1964 | Hasegawa, K. M. |
| 2. Mt. Myōgi, Kanra-gun, Gumma Pref. | Aug., 1967 | Hasegawa, K. M. |
| 3. Niiza, Kitaadachi-gun, Saitama Pref. | June, 1965 | Ohashi, H. |
| 4. Naguri, Iruma-gun, Saitama Pref. | Mar., 1967 | Sasaki, I. |
| 5. Katsuyama, Awa-gun, Chiba Pref. | Nov., 1966 | Kanai,H.,Ohashi, H., & Okubo, K. |
| 6. Ōizumi, Nerima-ku, Tokyo | Apr., 1966 | Hasegawa, K. M. |
| 7. Mt. Takao, Minamitama-gun, Tokyo | Oct., 1965 | Hasegawa, K. M. |
| 8. Hikawa, Nishitama-gun, Tokyo | Sept., 1964 | Hasegawa, K. M. |
| 9. Kamakura-City, Kanagawa Pref. | Sept., 1965 | Hasegawa, K. M. |
| 10. Uchigō, Tsukui-gun, Kanagawa Pref. | Oct., 1967 | Sugiyama, M. |
| 11. Fujigawa, Ibara-gun, Shizuoka Pref. | Apr., 1966 | Hasegawa, K. M. |
| 12. Ojima, Ibara-gun, Shizuoka Pref. | Apr., 1966 | Hasegawa, K. M. |
| 13. Tenryū-City, Shizuoka Pref. | June, 1965 | Hasegawa, K. M. |
| 14. Shimada-City, Shizuoka Pref. | Nov., 1967 | Tuyama, T. |
| 15. Takatsuki-City, Osaka | Oct., 1965 | Hotta, M. |
| 16. Ise-City, Mie Pref. | Sept., 1967 | Chūma, C. |
| 17. Goza, Shima-gun, Mie Pref. | Sept., 1967 | Chūma, C. |
| 18. Owase-City, Mie Pref. | Apr., 1967 | Sasaki, I. & Okada, M. |
| 19. Ikura, Niimi-City, Okayama Pref. | Dec., 1965 | Nakahara, K. |
| 20. Uchimi, Shōdo Island, Kagawa Pref. | May, 1965 | Ihara, H. |
| 21. Kahoku, Kami-gun, Kōchi Pref. | May, 1967 | Sasaki, I. & Kido, S. |
| 22. Mie, Ōno-gun, Ōita Pref. | | Hara, H. |
| 23. Akitsu, Kumamoto-City, Kumamoto Pref. | July, 1965 | Hasegawa, K. M. |
| 24. Ōmura-Cty, Nagasaki Pref. | Feb., 1965 | Toyama, S. |
| Chechu-Island, Korea | 1966 | Lee, Y. N. |
| Milyang, Kyongsangnum-Do, Korea | 1966 | Lee, Y. N. |
| A variety with broader leaves cultivated in Tokyo | | Hara, H. |
| A variety with variegated leaves cultivated in Tokyo | | Hara, H. |
| *Liriope spicata* | | |
| 1. Atsumi Peninsula, Aichi Pref. | Mar., 1966 | Okubo, K. |

| | Locality | Date | Collectors |
|---|---|---|---|
| 2. | Mt. Abu, Takatsuki-City, Ōsaka | Oct., 1965 | Ihara, M. |
| 3. | Owase-City, Mie Pref. | Oct., 1965 | Hotta, M. |
| 4. | Urato, Kōchi-City, Kōchi Pref. | Oct., 1965 | Hotta, M. |
| 5. | Mt. Ishidate, Kami-gun, Kōchi Pref. | May, 1966 | Ohashi, H. |
| 6. | Tosayamada, Kami-gun, Kōchi Pref. | May, 1967 | Sasaki, I. & Kido, S. |
| 7. | Ōtoyo, Nagaoka-gun, Kōchi Pref. | Oct., 1965 | Hotta, M. |
| 8. | Mt. Iwaudo, Yatsushiro-gun, Kumamoto Pref. | Oct., 1965 | Hotta, M. |
| Kwangnung, Kyonggi-Do, Korea | | 1965 | Lee, T. B. |
| A variety with variegated leaves cultivated in Tokyo | | | Hara, H. |
| *Ophiopogon jaburan* | | | |
| 1. | Hiramatsu, Kagoshima-City, Kagoshima Pref. | July, 1965 | Hasegawa, K. M. |
| 2. | Shiroyama, Kagoshima-City, Kagoshima Pref. | July, 1965 | Hasegawa, K. M. |
| 3. | Koshiki Island, Satsuma-gun, Kagoshima Pref. | Oct., 1965 | Hotta, M. |
| A variety with variegated leaves cultivated in Tokyo | | | Sasaki, I. |
| *Ophiopogon planiscapus* | | | |
| 1. | *Sendai-City, Miyagi Pref. | May, 1965 | Ohashi, H. |
| 2. | Hanaishi, Nikko-City, Tochigi Pref. | June, 1966 | Hasegawa, K. M. |
| 3. | Yokokawa, Usui-gun, Gumma Pref. | Nov., 1966 | Hasegawa, K. M. |
| 4. | Ogawa, Hiki-gun, Saitama Pref. | May, 1964 | Hasegawa, K. M. |
| 5. | Mt. Mitsumine, Chichibu-gun, Saitama Pref. | June, 1965 | Hasegawa, K. M. |
| 6. | Mt. Nokogiri, Awa-gun, Chiba Pref. | June, 1966 | Itō, I. |
| 7. | Hikawa, Nishitama-gun, Tokyo | Sept., 1964 | Hasegawa, K. M. |
| 8. | Hinohara, Nishitama-gun, Tokyo | 1965 | Kanai H. |
| 9. | Mt. Takao, Minamitama-gun, Tokyo | Oct., 1965 | Hasegawa, K. M. |
| 10. | Kamakura-City, Kanagawa Pref. | Sept., 1965 | Hasegawa, K. M. |
| 11. | Mt. Takiko, Ōtsuki-City, Yamanashi Pref. | Apr., 1965 | Hasegawa, K. M. |
| 12. | Sakae, Nishiyatsushiro-gun, Yamanashi Pref. | Apr., 1966 | Hasegawa, K. M. |
| 13. | Matsuno, Ibara-gun, Shizuoka Pref. | Apr., 1966 | Hasegawa, K. M. |
| 14. | Fujigawa, Ibara-gun, Shizuoka Pref. | Apr., 1966 | Hasegawa, K. M. |
| 15. | Yugashima, Izu Peninsula, Shizuoka Pref. | Oct., 1965 | Hasegawa, K. M. |
| 16. | Tajima, Izu Peninsula, Shizuoka Pref. | Oct., 1965 | Hasegawa, K. M. |
| 17. | Mt. Ryūsō, Shizuoka-City, Shizuoka Pref. | Oct., 1965 | Hotta, M. |
| 18. | Mt. Katamuki, Ōno-gun, Ōita Pref. | Oct., 1965 | Hotta, M. |
| 19. | Takachiho, Nishiusuki-gun, Miyazaki Pref. | July, 1965 | Hasegawa, K. M. |

| Locality | Date | Collectors |
|---|---|---|
| 20. Udo, Minaminaka-gun, Miyazaki Pref. | | Hara, H. |
| A variety with dark-purple leaves, "Kuroran", cultivated in Tokyo | | Hara, H. |
| * A variety with white flowers. | | |
| *Ophiopogon japonicus* | | |
| 1. Sendai-City, Miyagi Pref. | May, 1965 | Ohashi, H. |
| 2. Utsunomiya-City, Tochigi Pref. | Aug., 1964 | Hasegawa, K. M. |
| 3. Niiya, Kanra-gun, Gumma Pref. | June, 1966 | Hasegawa, K. M. |
| 4. Mt. Takao, Minamitama-gun, Tokyo | Oct., 1965 | Hasegawa, K. M. |
| 5. Meguro, Meguro-ku, Tokyo | May, 1964 | Hara, H. |
| 6. Kamakura-City, Kanagawa Pref. | Sept., 1965 | Hasegawa, K. M. |
| 7. Sakae, Nishiyatsushiro-gun, Yamanashi Pref. | Apr., 1966 | Hasegawa, K. M. |
| 8. Ojima, Ibara-gun, Shizuoka Pref. | June, 1966 | Hasegawa, K. M. |
| 9. Tenryū-City, Shizuoka Pref. | June, 1965 | Hasegawa, K. M. |
| 10. Tajima, Izu Peninsula, Shizuoka Pref. | Oct., 1965 | Hasegawa, K. M. |
| 11. Kurokabe, Kanazawa-City, Ishikawa Pref. | Mar., 1964 | Ihara, M. |
| 12. Kamiichi, Nakaniikawa-gun, Toyama Pref. | Mar., 1965 | Ihara, M. |
| 13. Noda, Atsumi-gun, Aichi Pref. | Mar., 1966 | Ihara, M. |
| 14. Honzanji, Takatsuki-City, Ōsaka | Oct., 1965 | Hotta, M. |
| 15. Owase-City, Mie Pref. | Oct., 1965 | Hotta, M. |
| 16. Owase-City, Mie Pref. | Apr., 1967 | Sasaki, I. & Okada, M. |
| 17. Bizen, Wake-gun, Okayama Pref. | Dec., 1965 | Nakahara, K. |
| 18. Miyoshi, Futami-gun, Hiroshima Pref. | Sept., 1965 | Nakahara, K. |
| 19. Tosayamada, Kami-gun, Kōchi Pref. | May, 1967 | Sasaki, I. & Kido, S. |
| 20. Kahoku, Kami-gun, Kōchi Pref. | May, 1967 | Sasaki, I. & Kido, S. |
| 21. Tosashimizu-City, Kōchi Pref. | Apr., 1967 | Sasaki, I. |
| 22. Nakabaru, Sanyōki-gun, Saga Pref. | Oct., 1965 | Ihara, M. |
| 23. Akitsu, Kumamoto-City, Kumamoto Pref. | July, 1965 | Hasegawa, K. M. |
| 24. Takachiho, Nishiusuki-gun, Miyazaki Pref. | July, 1965 | Hasegawa, K. M. |
| Chechu-Island, Korea | 1966 | Lee, Y. N. |
| A material cultivated in Tokyo | | Hasegawa, K. M. |
| A material cultivated in Tokyo | | Yamazaki, T. |
| A material cultivated in Kyôto | | Hasegawa, K. M. |
| *Ophiopogon ohwii* | | |

| | Locality | Date | Collectors |
|---|---|---|---|
| 1. | Ogawa, Hiki-gun, Saitama Pref. | May, 1964 | Hasegawa, K. M. |
| 2. | Katsuyama, Awa-gun, Chiba Pref. | Nov., 1965 | Kanai,H.,Ohashi, H., & Okubo, K. |
| 3. | Mt. Nokogiri, Awa-gun, Chiba Pref. | Mar., 1965 | Hasegawa, K. M. |
| 4. | Ōizumi, Nerima-ku, Tokyo | Apr., 1966 | Hasegawa, K. M. |
| 5. | Narimasu, Itabashi-ku, Tokyo | 1964 | Hara, H. |
| 6. | Kiyose, Kitatama-gun, Tokyo | Apr., 1966 | Ohashi, H. |
| 7. | Mt. Takao, Minamitama-gun, Tokyo | Oct., 1965 | Hasegawa, K. M. |
| 8. | Kamakura-City, Kanagawa Pref. | Sept., 1965 | Hasegawa, K. M. |
| 9. | Misaki, Miura-City, Kanagawa Pref. | May, 1965 | Hasegawa, K. M. |
| 10. | Sakae, Nishiyatsushiro-gun, Yamanashi Pref. | Apr., 1966 | Hasegawa, K. M. |
| 11. | Fujigawa, Ibara-gun, Shizuoka Pref. | Apr., 1966 | Hasegawa, K. M. |
| 12. | Matsuno, Ibara-gun, Shizuoka Pref. | Apr., 1966 | Hasegawa, K. M. |
| 13. | Tenryū-City, Shizuoka Pref. | Oct., 1965 | Hasegawa, K. M. |
| 14. | Tajima, Izu Peninsula, Shizuoka Pref. | Oct., 1965 | Hasegawa, K. M. |
| 15. | Yugashima, Izu Peninsula, Shizuoka Pref. | Oct., 1965 | Hasegawa, K. M. |
| 16. | Higashinagae, Kanazawa-City, Ishikawa Pref. | Mar., 1964 | Ihara, M. |
| 17. | Nariai, Takatsuki-City, Osaka | Oct., 1965 | Hotta, M. |
| 18. | Owase-City, Mie Pref. | Oct., 1965 | Hotta, M. |
| 19. | Ikura, Niimi-City, Okayama Pref. | Dec., 1965 | Nakahara, K. |
| 20. | Ōsaka Pass, Nangoku-City, Kōchi Pref. | June, 1966 | Ohashi, H. |
| 21. | Kahoku, Kami-gun, Kōchi Pref. | May, 1967 | Sasaki, I. & Kido, S. |
| 22. | Monobe, Kami-gun, Kōchi Pref. | Apr., 1967 | Sasaki, I. & Kido, S. |
| 23. | Akitsu, Kumamoto-City, Kumamoto Pref. | July, 1965 | Hasegawa, K. M. |
| 24. | Udo, Udo-gun, Kumamoto Pref. | Oct., 1965 | Hotta, M. |
| 25. | Hiramatsu, Kagoshima-City, Kagoshima Pref. | July, 1965 | Hasegawa, K. M. |
| 26. | Mt. Takakuma, Kimotsuki-gun, Kagoshima Pref. | July, 1965 | Hasegawa, K. M. |
| A material cultivated in Tokyo | | | Hasegawa, K. M. |

**Key to species**

1. *Liriope*

A. Leaves 1.0-2.0 (-2.5) mm wide; inflorescence 1-4 cm long with (4-) 5-8 (-10) flowers; stoloniferous .....1. *L. minor*

A. Leaves 3-12 mm wide; inflorescence 5-17 cm long with 30-120 flowers.

B. Leaves 6-12 mm wide; inflorescence 5-17 cm long, densely flowered; estoloniferous .....2. *L. platyphylla*

B. Leaves 3-5 (-6) mm wide; inflorescence 3-8 cm long, loosely flowered; mostly stoloniferous .....3. *L. spicata*

2. *Ophiopogon*

A. Leaves 8-15 mm wide; pedicel 10-20 mm long; seeds more or less ovate, 9-10 mm across, cobalt-blue; densely fasciculate, estoloniferous .....1. *O. jaburan*

A. Leaves 2-6 mm wide; pedicel 3-7 mm long; seeds globose, 6-9 mm across.

B. Leaves 4-6 mm wide; seeds 6-8 mm across, blackish; stoloniferous .....2. *O. planiscapus*

B. Leaves 2-3 mm wide; seeds 7-9 mm across, cobalt-blue.

C. Leaves 8-25 (-30) cm long; a scape 4-8 (-9) cm long; stoloniferous.....3. *O. japonicus*

C. Leaves 30-55 cm long; a scape 10-18 cm long; densely fasciculate, estoloniferous .....4. *O. ohwii*

1. *Liriope*

1) **Liriope minor** (Maxim.) Makino This species is widely spread in Japan from Hokkaido southwards to Kyūshū, and is the only species found from Hokkaido in Ophiopogoneae. The habitats are from littoral grasslands to the higher moist woods up to 1000 m high. It flowers from middle July to middle August. A short scape 6-15 cm long bears a few flowers mostly five to eight; the perianths are light purple, and the seeds are blackish, and globose 5-6 mm in diameter. The leaves are narrow and the length is variable from 5 to 25 cm. Always it has long stolons. The chromosomes of 17 materials collected from Hokkaido to Shikoku were studied; the chromosome number of all materials was found to be 2n=36, and the karyotype was also stable. It was expressed as follows;

$$K\ (2n)=36=2V+16J+2j^{t}+16j \quad \text{(Pl. XII, C; XIII, C)}$$

This observation almost accords with the reports by Sato, D. and Oinuma, T.

2) **Liriope platyphylla** Wang et Tang This species is also widely distributed in Japan except Hokkaido. It is cultivated everywhere and the varieties with broader leaves or variegated leaves are often found. It has large leaves 30-60 cm long, 6-12 mm wide, and long scape with inflorescence 5-17 cm long. It flowers from late August to late September; the perianths are light purple and the seeds are blackish. It has no stolon. The chromosomes of 24 materials collected from Tōhoku to Kyūshū regions and two cultivated varieties with broader leaves and variegated leaves were observed. The chromosome number was, however, all

2n=72 and the karyotype was stable. It was expressed as follows;

K (2n)=72=4V+32J+36j (Pl. XII, D; XIV, D)

Comparing the karyotype of *L. minor* with that of *L. platyphylla*, *L. minor* is considered to be diploid and *L. platyphylla* to be tetraploid. This observation almost accords with the report of Oinuma, T., but two pairs of satellite chromosomes which he described were difficult to observe. Oinuma, T. further reported the race with 2n=108 chromosomes and recognized the intraspecific polyploidy, but they were not observed in this study.

Two plants of *L. platyphylla* collected from Milyang and Chechu-Island, Korea, were also observed to be 2n=72, and the karyotype was almost similar to that of Japanese species.

3) **Liriope spicata** Lour. In Japan the distribution of *L. spicata* is limited in southern parts; Kyūshū, Shikoku, Chūgoku, and Kinki regions and rarely in Tōkaido regions. Generally the leaves are narrower 3-5 (-6) mm wide, the inflorescence is looser and the color of the perianths is lighter than that of *L. platyphylla*. The seeds are blackish like those of *L. minor* or *L. platyphylla*. Sometimes it looks like *L. platyphylla*, but *L. spicata* mostly has stolons and the flowering time is about a month earlier than *L. platyphylla*. The chromosomes of 8 materials collected from Kyūshū, Shikoku, Kii Peninsula and Atsumi Peninsula, and a variegated variety were observed. Then, 7 wild materials and a variegated one were found to be 2n=108, and the karyotype was expressed as follows;

K (2n)=108=6V+48J+54j (Pl. XII, B; XIII, B)

It is considered to be hexaploid, and this result accords with the report by Sato, D. A plant of this species collected from Kwangnung, Korea was also observed to be 2n=108, and it was morphologically similar to the Japanese species. Oinuma, T. described *L. platyphylla* in Hiroshima with 2n=108 chromosomes, but this material may be considered to be *L. spicata*.

On the other hand, three plants collected from Mt. Iwaudo, Yatsushiro-gun Kumamoto Prefecture by Dr. Hotta, M., Kobe Women's College, were found to be 2n=36. The karyotype was expressed as follows;

K (2n)=36=2V+16J+2$j^t$+16j (Pl. XII, A; XIII, A)

One pair of small j-shaped chromosomes has satellite, and this karyotype is almost similar to that of *L. minor*. These plants have been cultivated at Tokyo for four years. They flowered from middle July to early August every year, and this flowering time is about a month earlier than any other *L. spicata*. The inflo-

rescence and the flower structure are similar to those of the others, but the perianths are almost white, and they have been sterile for four years. All three plants have no stolon, smaller as a whole, and the leaves' green darker than the other *L. spicata*. *L. spicata* is distributed not only in Japan but also widely in the other areas, and those exotic materials must be precisely studied. In the present study, further more analyses were difficult, however, this plant may supply an important question considering the phyletic relation of *Liriope* species.

2. *Ophiopogon*

1) **Ophiopogon jaburan** (Kunth) Lodd. This species is distributed in the littoral regions of the southern parts; Kyūshū, Shikoku, Chūgoku regions and Kinki Peninsula, and north to Awashima Island, Niigata Prefecture isolatedly. It is very large as a whole; the scape up to 40-80 cm tall, 4-8 mm wide, and the leaves are 50-90 cm long, 8-15 mm wide and thicker than the other species. It flowers from early August to September; the pedicel is 10-20 mm long, the perianths are white, and the seeds are more or less ovate 9-10 mm in diameter and are cobalt-blue. It is cultivated especially in the southern parts of Japan and the variety with variegated leaves is also cultivated.

The chromosomes of three materials and one variegated variety were observed. All the materials were found to be 2n=36 and the karyotype was expressed as follows;

$$K\ (2n)=36=2V+4J+18j+2j^{t}+10v \qquad \text{(Pl. XII, E; XIV, E)}$$

A pair of V-shaped chromosomes, two pairs of J-shaped, and a pair of j-shaped chromosomes with large satellite were very characteristic. The chromosome size about twice larger than that of the other species was also remarkable. This observation were almost similar to the reports of Matsuura, H. & Suto, T. and Sato, D., and the species is considered to be diploid as described by Sato, D.

2) **Ophiopogon planiscapus** Nakai This species is distributed all over Japan except Hokkaido, and the variety with white flowers is often found in the wild. The variety with dark purple leaves, 'Kuroran' is common in the Japanese garden. It flowers from late June to late July; the scape is 15-25 cm long, 2-2.5 mm wide, the pedicel is 3-7 mm long, 1 mm wide, and the perianths are light purple like those of *O. japonicus* or *O. ohwii*. The blackish seeds like those of *Liriope* are characteristic in the Japanese species of *Ophiopogon*, and the seeds are globose, 6-8 mm in diameter. The leaves are 4-6 mm wide and 18-35 cm long. Always it has long stolons.

The chromosomes of 20 materials (including a plant with white flowers) collected

from Tōhoku to Kyūshū were observed, and they were all 2n=36, the karyotype was stable as follows;

K (2n)=36=2V+16J+18j (Pl. XII, F; XV, F)

No satellite chromosome was observed in this study as it had been reported by Oinuma, T. The cultivated variety with purple leaves had also similar chromosomes. Sato, D. reported this species to have 2n=72 chromosomes, on the other hand, Oinuma, T. reported two races, 2n=36 and 2n=72, and he recognized the intraspecific polyploidy of *O. planiscapus*. In the present study, however, no plant with 2n=72 chromosomes was observed.

3) **Ophiopogon japonicus** (L. f.) Ker-Gawl. This species is widely distributed in Japan except Hokkaido and it is cultivated everywhere. It flowers from middle July to August; the scape is slender, 1 mm wide and 4-8 (-10) cm long, the pedicel is also slender, 0.5 mm wide and 3-7 mm long, and the perianths are light purple like those of *O. planiscapus*. The seeds are cobalt-blue, globose 7-9 mm in diameter. The leaves are 8-25 (-30) cm long and often curved outside. It has stolons.

The chromosomes of 24 materials and two cultivated ones were studied. The chromosome numbers were all 2n=72, and the karyotype was stable through all the materials, expressed as follows;

K (2n)=72=4V+24J+8v+4j$^s$+32j (Pl. XII, G; XV, G)

Two pairs of large V-shaped chromosomes and two pairs of j-shaped chromosomes with secondary constriction were characteristic, and this observation were almost similar to the reports of Sato, D. and Oinuma, T. This is considered to be tetraploid as the previous authors explained. This species with 2n=36 chromosomes had been also reported by Sato, D., but it was not observed in the present study. It is very interesting that recently Nagamatsu, T. & Noda, S. reported the several kinds of hypo-tetraploid in *O. japonicus*.

The chromosome of a plant collected from Chechu-Island, Korea, was also observed to be 2n=72, and the karyotype was almost similar to that of Japanese species.

4) **Ophiopogon ohwii** Okuyama This species is also widely distributed in Japan except Hokkaido, and is cultivated everywhere. It flowers from middle July to August; the scape is so long 10-18 cm, and 1 mm wide, the pedicel is 0.5 mm wide and 3-7 mm long, and the perianths are light purple like those of *O. japonicus*. The seeds are cobalt-blue, spherical, 7-9 mm in diameter. The leaves are

30-55 cm long, not so curved outside as *O. japonicus*. It has no stolon, but the roots and leaves are densely fasciculate. *O. ohwii* has often been treated as *O. japonicus*, but the long leaves and scape, and the fasciculate roots and leaves are very characteristic.

The chromosomes of 26 materials and a cultivated one were studied, and the chromosome numbers were all 2n=72, the karyotype was stable through all the materials. It was expressed as follows;

$$K\ (2n)=72=4V+24J+8v+4j^{s}+32j \qquad \text{(Pl. XII, H; XV, H)}$$

The chromosome number and the karyotype of *O. ohwii* were found to be similar to those of *O. japonicus*. Perhaps they had been observed by the previous authors as *O. japonicus*.

**Conclusion** All the species of *Liriope* and *Ophiopogon* in Japan were cytotaxonomically studied. The morphological characters of each species were carefully observed, then the chromosome number and karyotype were studied by the materials from many different localities. The results were expressed as follows;

| | |
|---|---|
| *L. minor* | $K\ (2n)=36=2V+16J+2j^{t}+16j$ |
| *L. platyphylla* | $K\ (2n)=72=4V+32J+36j$ |
| *L. spicata* | $K\ (2n)=36=2V+16J+2j^{t}+16j$ |
| | $K\ (2n)=108=6V+48J+54j$ |
| *O. jaburan* | $K\ (2n)=36=2V+4J+18j+2j^{t}+10v$ |
| *O. planiscapus* | $K\ (2n)=36=2V+16J+18j$ |
| *O. japonicus* | $K\ (2n)=72=4V+24J+8v+4j^{s}+32j$ |
| *O. ohwii* | $K\ (2n)=72=4V+24J+8v+4j^{s}+32j$ |

Excepting *L. spicata*, the chromosome number and karyotype were stable in each species, and the intraspecific polyploidy reported by the previous authors was not found. The chromosomes of the variegated varieties were not different from their mother species. *O. ohwii* which had perhaps been reported as *O. japonicus* was found to have the same chromosome as *O. japonicus*. *L. spicata* with 2n=36 chromosomes was first observed by the materials collected from Mt. Iwaudo, Kumamoto Prefecture, but the signification of this plants among the *Liriope* species has not been cleared as yet. The chromosomes of three Korean species; *L. spicata*, *L. platyphylla* and *O. japonicus* were comparatively observed, and their chromosome number and karyotype were found to be almost similar to those of Japanese species.

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## Main References

Bailey, L. H. 1929. Gentes Herbarum (The kinds of plants) 1. The case of *Ophiopogon* and *Liriope*. Vol. II. Fasc. 1. p. 1-37. Ithaca, New York. Hume, H. H. 1961. The *Ophiopogon-Liriope* Complex. Baileya **9**: 135-158. Larsen, K. 1963. Studies in the flora of Thailand 14. Cytological studies in vascular plants of Thailand. Dansk Bot. Arkiv **20**: 211-275. Matsuura, H. and Suto, T. 1935. Contributions to the Idiogram Study in Phanerogamous Plants I. Journ. Fac. Sci. Hokkaido Univ. **5** (5): 33-75. Nagamatsu, T. and Noda, S. 1964. Chromosome Constitution of *Ophiopogon japonicus*. Bull. Osaka Gakuin Univ. No. 3: 185-190. —— and —— 1967. Predominancy of two types of hypo-tetraploids in *Ophiopogon japonicus*. Jap. J. Breeding **17** Sup. 2: 171. Nakai, T. 1934. Notulae ad Plantas Japoniae & Koreae XLIV. Bot. Mag. Tokyo **48**: 773-792. Ohwi, J. 1965. Flora of Japan. 2nd ed. Shibundo, Tokyo. Oinuma, T. 1944. Chromosome number of *Ophiopogon planiscapus* Nakai. Jap. Journ. Genet. **20**: 130-131. —— 1946. Karyotype analysis of Liriope and Ophiopogon. La Kromosomo **2**: 71-75. —— 1949. Further studies on chromosomes of Ophiopogonaceae. Jap. Journ. Genet. Sup. **2**: 29-34. Sato, D. 1942. Karyotype alteration phylogeny in Liliaceae and allied families. Jap. Journ. Bot. **12**: 58-161. Shimotomai, N. 1927. Über Störungen der meiotischen Teilungen durch niedrige Temperatur. Bot. Mag. Tokyo **41**: 149-160.

## Explanation of the Plates XII—XV

Pl. XII Somatic chromosomes of the species of *Liriope* and *Ophiopogon* in Japan. A. *L. spicata* (Mt. Iwaudo, Kumamoto Pref.) B. *L. spicata* (Tosayamada, Kōchi Pref.) C. *L. minor* (Shimoda, Shizuoka Pref.) D. *L. platyphylla* (Mt. Myōgi, Gumma Pref.) E. *O. jaburan* (Hiramatsu, Kagoshima City) F. *O. planiscapus* (Mt. Mitsumine, Saitama Pref.) G. *O. japonicus* (Ojima, Shizuoka

Pref.)　H. *O. ohwii* (Matsuno, Shizuoka Pref.)

Pl. XIII—XV　Somatic chromosomes of the species of *Liriope* and *Ophiopogon*. Karyograms produced from each picture of Plate XII.

*　　*　　*　　*

*Liriope*（ヤブラン属）と *Ophiopogon*（ジャノヒゲ属）はアジアの温帯から亜熱帯にかけて広く分布し，日本には *Liriope* は 3 種，*L. minor* (Maxim.) Makino（ヒメヤブラン），*L. platyphylla* Wang et Tang（ヤブラン），*L. spicata* Lour.（コヤブラン）があり，*Ophiopogon* は 4 種，*O. jaburan* (Kunth) Lodd.（ノシラン），*O. planiscapus* Nakai（オオバジャノヒゲ），*O. japonicus* (L. f.) Ker-Gawl.（ジャノヒゲ），*O. ohwii* Okuyama（ナガバジャノヒゲ）が知られている。これらはだいたい，北海道を除く日本全国いたるところの低地の草原や森林に分布しているが，北海道では南端に *L. minor* が見られるだけである。また，*L. spicata* および *O. jaburan* は主に本州中部以西に分布し，関東や東北地方には見られない。この 2 属は，花後ただちに心皮が裂開して種子が露出する点で，ユリ科の中では特殊な群である。細胞学的には，基本数は18と考えられており，これまでに下斗米 1927，松浦・須藤 1935，佐藤 1942，生沼 1944，'46，'49，永松・野田 1964，'67 等によって染色体の研究が行われ，種内倍数性も報告されている。しかしながら，この 2 属に含まれる種の中には，花や種子が無い時には区別がつきにくいものが多く，これまでの研究でも用いられた材料の証拠標本も無く，種の同定と材料の出所についてはかなりの疑問が残されている。本研究では日本産 2 属 7 種の形態的特徴を明らかにした上で，各々の種について，日本各所から出来るだけ多くの自生の材料を集め，それらの染色体をしらべることにより，種間の関係，また種内倍数性をさらに明らかにすることを試みた。又，この二属は古くから栽培されているものが多く，斑入りなどの品種もあるのでこれら栽培品にも十分注意してしらべてみた。用いた材料については Table 2 にに示されてある。

その結果，*L. spicata* を除いた *Liriope* 2 種と，*Ophiopogon* 4 種は，すべて種によって染色体数と核型は一定しており，これまでの報告にある種内倍数性は見られなかった。染色体数は *L. minor* 2n=36，*L. platyphylla* 2n=72，*O. jaburan* 2n=36，*O. planiscapus* 2n=36，*O. japonicus* 2n=72，*O. ohwii* 2n=72 である。またこれらの核型から，2n=36 は 2 倍体，2n=72 は 4 倍体と考えられる。普通の栽培品及び斑入り等の品種についてしらべた結果も，各々の自生種の染色体と全く同じであった。李昌福博士および李永魯博士から送られた韓国自生の *L. platyphylla* と *O. japonicus* も参考にしらべてみたが，日本の各々の種と染色体数も核型も同じであった。この結果から日本の中では *L. minor*, *L. platyphylla*, *O. jaburan*, *O. planiscapus*, *O. japonicus*, *O. ohwii* の 6 種は，各々一定の数及び核型の染色体を持ち，各種内では倍

数性もみられないと考えられる。また本研究では見られなかったのであるが，永松・野田 1964，'67 は日本の数箇所で採集された *O. japonicus* について低四倍体 (2n=65, 66, 67, 68) を報告しており，大変興味深い。

*L. spicata* については自生の 7 箇所の材料と，斑入りの園芸品種，及び参考にしらべた韓国自生の一株の染色体は，すべて 6 倍体と考えられる 2n=108 であった。ところが熊本県八代郡岩宇土山で堀田満氏によって採集されたものだけは 2n=36 で，核型は *L. minor* の核型とほぼ同じであった。この植物は花序及び花の形態と葉の形態からは，明らかに *L. spicata* と考えられるが，4 年間東京で栽培した限りでは，2n=108 のものに比べて，花期が約一カ月早く，花被は完全な白色で，葉の表面の緑が濃く，ストロンを出さないという点でかなり異っている。この植物は *Liriope* の系統をしらべる上で大変意味があると考えられるが，現在の資料だけからではこれ以上の分析は出来ない。*L. spicata* は，日本以外の地域にも広く分布しているので，それらの材料についても今後十分に検討しなくてはならない。

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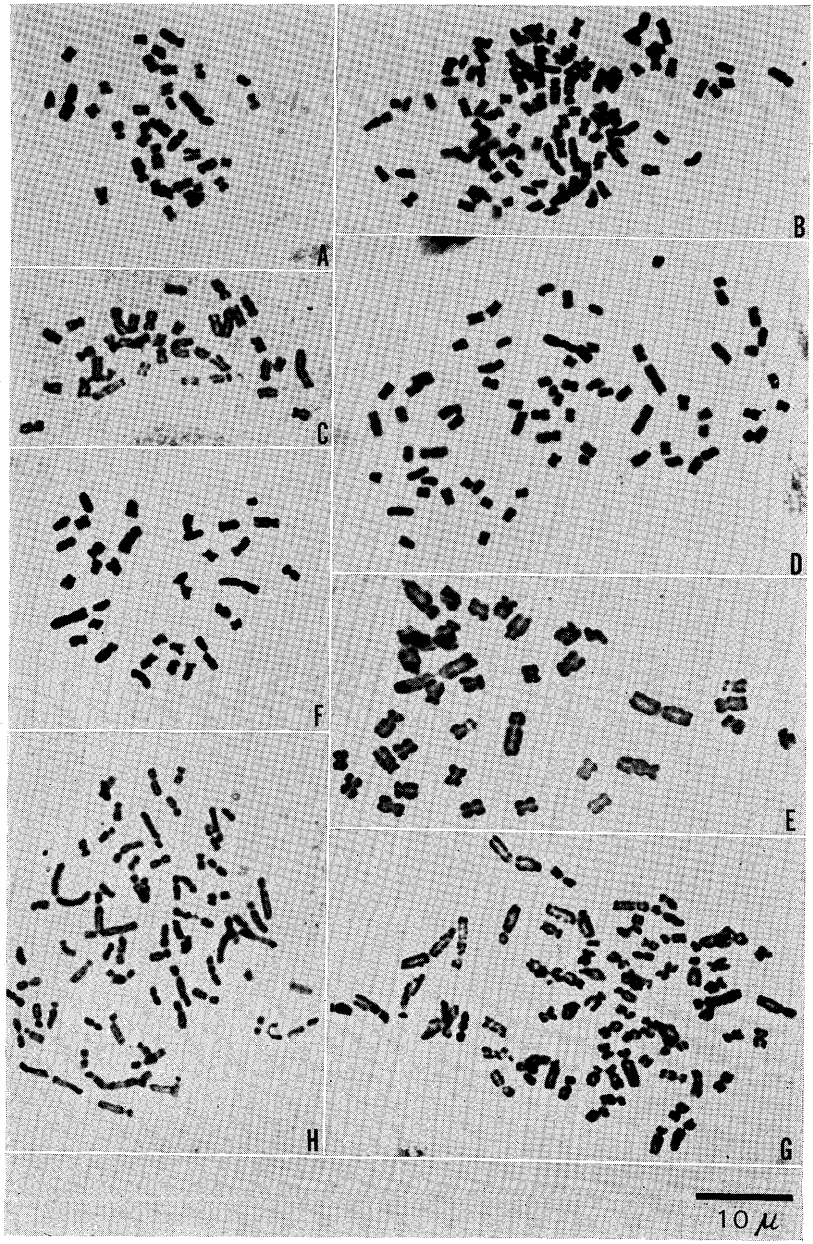
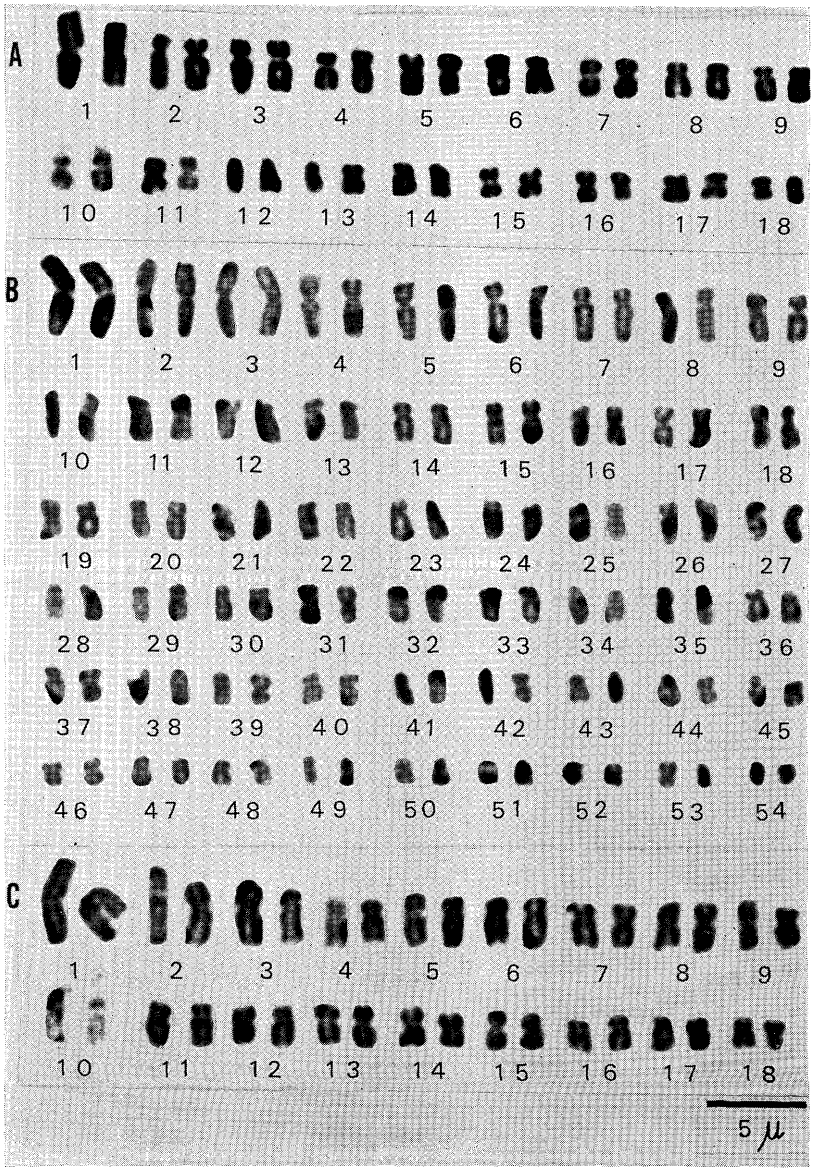
## ○外来室内植物二件（久内清孝） Kiyotaka HISAUCHI: Two new indoor plants to Japan

昨年中秋のころ，東京都内で 2 種の外来室内観賞用の植物を手に入れたので，一応型のごとくしらべて見たところ，いづれも中米あたりを中心とする低木で，すでに前世紀中に命名されて，園芸的に利用されているものであることがわかったけれども，我国にはあまり広く行き渡っていないらしいので，記録しておくことにした。そのひとつはミソハギ科に属しているもので *Cuphaea hyssopifolia* St. Hill (1877) に該当し，この属にはハナヤナギの和名が与えられているものがあるので，それにちなみ，メキシコハナヤナギと呼称することにした。なるべく，紙面を節約する本誌の方針上，文献のら列や記載は略して，概形は写真にゆづるが，葉形は線状楕円形で長さは約 2 cm，花弁は紅色で径 6—7 mm で上向に咲き，萼片は約12歯に別れて，花後にもなお残存する。挿木で増殖できるので普及する可能性があるためか，東京近郊の店頭には，これを見かける機会が少くなく，籾山泰一氏も鎌倉市内で入手されて，私と同じように同定された。私は平凡な本で見てきめたのだが同氏は，たんねんに Das Pflanzenreich でしらべられた上でのことであるから，この同定は確かなものと思われる。

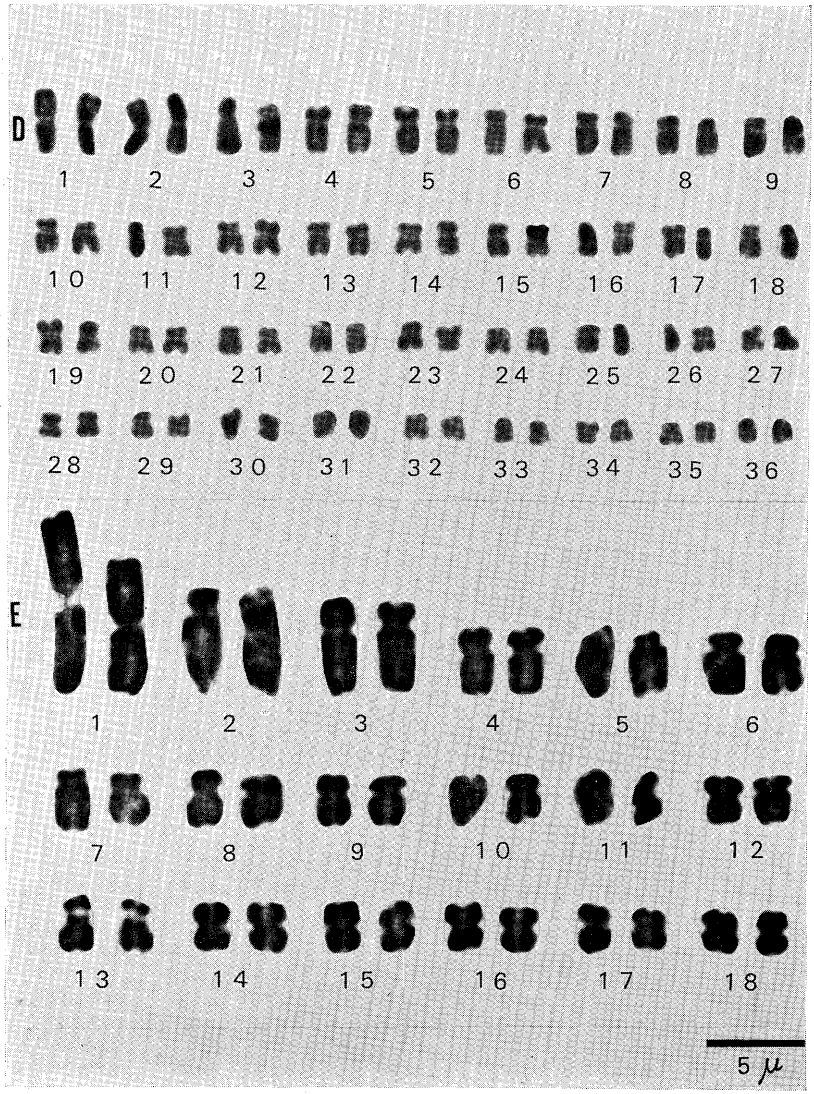
その第二はカタバミ科の低木である。草だけしか見ていないこの科の木本であるから井の中の蛙には珍らしい。一見したとこでは，葉は 3 数性の複葉で，ハギの類に似ている。学名は *Oxalis hedysaroides* H. B. K. (1884) で，いかにもマメ科くさい名なのであるから，ハギを連想させるような和名がほしいのだが，既に渡辺清彦博士が，これに似たべつのものに，昭南植物園発行 (1945) の南方圏有用植物図説で，ハギカタバミという名を与えているのに気付いたので，園芸上の米語名である Fire fern を邦語的に変



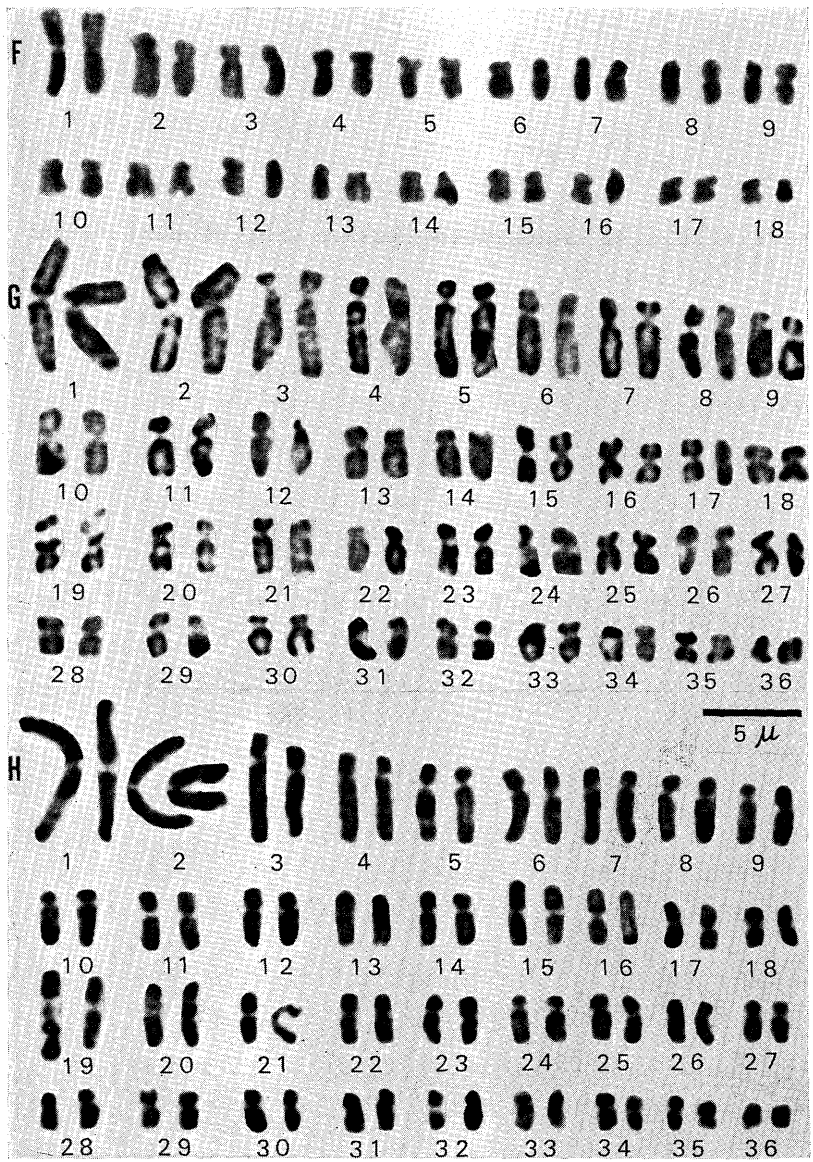

K. M. HASEGAWA : Somatic chromosomes of *Liriope* and *Ophiopogon*




K. M. Hasegawa : Somatic chromosomes of *Liriope* and *Ophiopogon*




K. M. HASEGAWA: Somatic chromosomes of *Liriope* and *Ophiopogon*




K. M. Hasegawa : Somatic chromosomes of *Liriope* and *Ophiopogon*